The Bartol Research Institute
A Brief History

Mr. Henry W. Bartol, a member of The Franklin Institute, died on the 19th of December, 1918, leaving behind a will and codicil that provided for the establishment of the Bartol Research Institute. In that will Mr. Bartol designated as residuary legatee the Franklin Institute of the State of Pennsylvania. He stipulated: "All the rest, residue and remainder of my estate, except such as is situated in France, I give, devise, and bequeath to the Franklin Institute... to be applied to the establishment and maintenance of a department of practical Electrical Engineering..." The codicil subsequently changed this to "...the founding and maintenance of an institute... the preference however, being given to workers or those making researches into electrical science."

Mr. Bartol was a prominent Philadelphia industrialist. Although his gift in 1918 was sufficient to fund an institute of scientific study, the birth of the Bartol Research Institute (then called the Bartol Research Foundation) was slow and difficult. It was not until the end of 1925 that the first Bartol Fellow, Dr. Arthur Bramley, was appointed. The first publication of research supported by the Bartol Research Foundation, and performed by Dr. Bramley, appeared in the January, 1926 issue of the *Journal of the Franklin Institute*. This report discussed the multiplet structure in the Zeeman effect. The number of Bartol Fellows rose to five and on February 3, 1927, Dr. W. F. G. Swann was elected by the Board of Managers to be the first director of the Bartol Research Foundation.

W. F. G. Swann was appointed the Director of the Bartol Research Foundation at the age of 43. Born in England, he was educated at Brighton Technical College, the Royal College of Science, University College, Kings College and the City Guilds of London Institute. Dr. Swann came to this country in 1913 as head of the Physical Division of the Department of Terrestrial Magnetism at the Carnegie Institute in Washington. Later he was Professor of Physics at the University of Minnesota, the University of Chicago and Yale, where he became Director of the Sloane Laboratory. A man of many talents, Dr. Swann was an accomplished cellist, founder of the Swarthmore Symphony Orchestra, a former assistant conductor of the Main Line Orchestra and former director of the Philadelphia Academy of Music.

By the time of his appointment, Professor Swann had already distinguished himself as an excellent teacher, an outstanding researcher, and an emerging leader of the scientific community. Although Dr. Swann is perhaps best known for his experimental and theoretical efforts in the area of cosmic ray physics, his research interests touched on many other disciplines such as condensed matter physics, relativity, and charged particle acceleration. In the last seven years of his life he had 22 publications on such diverse subjects as atmospheric electricity, thermal conductivity of solids, the restricted theory of relativity, matter, antimatter and gravitation, and charged particle acceleration to cosmic ray energies. His grasp of electromagnetism was far reaching and entered into most of his research. In his capacity as a professor he is perhaps best known as the advisor of Dr. E. O. Lawrence who subsequently was awarded the Nobel Prize for developing the cyclotron. Lawrence followed Dr. Swann from Minnesota, to Chicago, and then to Yale where he received his Ph.D. Altogether Dr. Swann had over 250 publications including a well known book "The Architecture of the Universe". In 1967 the International Astronomical Union honored

Professor Swann when it gave his name to a crater on the lunar surface at 52 ° north latitude and 112 ° east longitude.

Shortly after his appointment as Director of the Bartol Research Foundation, Dr. Swann secured an agreement with Swarthmore College to move the Foundation from its temporary lodgings in Philadelphia to the home campus of the college where it was able to enjoy the benefits of a college atmosphere. During the early 30's Dr. K. T. Bainbridge, then a Bartol scientist, developed a magnetic spectrograph with which he was able to make accurate mass determinations of low Z elements including ^{6}Li using their accelerator. At about the same time Cockroft and Walton performed measurements on the $^{7}Li + p = 2\alpha$ reaction using their accelerator. Bainbridge was then able to verify Einstein's famous principle of mass- energy equivalence using the established masses for the proton and ^{7}Li.

Several "high" altitude manned balloon flights were made in 1934 and '35 for the purpose of studying cosmic rays. Two of these, one of which crashed on descent, were sponsored by the National Geographic Society and the Army Air Corps and were flown by Air Corps personnel; fortunately the men on the crashed flight were able to eject and come down on parachute. Three other flights were flown by Dr. Jean Piccard and his wife. All of these flights contained a significant amount of Bartol equipment for the study of cosmic rays. Related investigations of cosmic rays were pursued from mountain tops, airplanes and ships, underwater, and in unmanned balloons.

Bartol became further involved in nuclear physics research with the construction of a 2.5 MV Van de Graaff accelerator under the guidance of Dr. W. E. Danforth. Bartol personnel also constructed a cyclotron in the late 1930's, the first cyclotron outside of Berkeley. This machine was actually built for The Franklin Institute's Biochemical Foundation, which was housed in the present Penny Hall of the University of Delaware. An extensive nuclear physics program did not develop until after World War II, with the completion of the 2.5 MV Van de Graaff and the construction of a second Van de Graaff with a potential of 5 MV. The principal research interests during the war, conducted in close collaboration with the Radiation Laboratory at the Massachusetts Institute of Technology, involved the development of magnetron cathodes. Basic research in solid state and surface physics continued after the war, in parallel with the resumption of cosmic ray investigations. Bartol's scope was further expanded in the 1960's with the initiation of research programs in astronomy and astrophysics.

Dr. Martin A. Pomerantz succeeded Prof. Swann as Director of the Bartol Research Foundation in 1959. In 1977, while under his direction, the Bartol Research Foundation moved to its present location in the H. Rodney Sharp Laboratory at the University of Delaware. The Bartol shares this main campus building with the Department of Physics and Astronomy, participating fully in the University's Joint Graduate Program in Physics and Astronomy.

Dr. Pomerantz is best known for his pioneering use of the South Pole as a laboratory for studies in astronomy and astrophysics. Although the Antarctic continent is a hostile environment that provides unique challenges for both man and machine, it also provides unique opportunities for the study of extraterrestrial physics. The dipolar nature of the Earth's magnetic field allows for the entry of cosmic rays at the poles without the impediment of the magnetic field common to other regions of the Earth. The extreme cold of the Antarctic winter reduces the atmospheric water vapor to values comparable to desert climates, allowing

for high resolution optical observations of the stars. Solar observations near the Earth's rotational axis provide for long duration runs, interrupted only by occasional summer storms. Using such unique features of Antarctica to greatest advantage, Dr. Pomerantz has directed the Bartol Research Institute's Antarctic research program for thirty years, initiating the cosmic ray and solar oscillation studies now performed there. In recognition of his pioneering efforts in Antarctic research, a highland plain at 70 ° south latitude and 160 ° east longitude now bears the name Pomerantz Tableland, since renamed the Martin A. Pomerantz Observatory.

As the new Director, Dr. Pomerantz continued to build on the traditional strengths of the Bartol Research Institute. Efforts to study the rapidly growing area of cosmic ray physics were increased and much of the pioneering research in this field has been conducted by members of Bartol's scientific staff over the years. New research programs in particle theory and cosmology were a natural outgrowth of the existing programs in nuclear physics and astrophysics.

Dr. Norman F. Ness succeeded Dr. Pomerantz as the Director (retitled President of the University of Delaware-Bartol Research Institute) in 1987. Previously, Dr. Ness was the Director of the Laboratory for Extraterrestrial Physics at NASA's Goddard Space Flight Center, where he earned an international reputation in the study of magnetic fields in interplanetary space and the physics of planetary magnetospheres. He has pioneered the construction of spacecraft-borne magnetometers and has been the Principal Investigator on magnetic field experiments flown on numerous Mariner, Pioneer, and IMP missions and on the Voyager spacecraft. His work has been central to the in *situ* study of the solar wind and the plasma environments and magnetic fields of Mercury, Earth, the Moon, Jupiter, Saturn, Uranus, and Neptune.

In July 2000, Bartol was fully integrated into the University of Delaware, becoming a unit within the College of Arts and Science. Dr. Stuart Pittel, a long-time member of the Bartol faculty, was named Acting Director of the Institute in September 2000 and a year later was appointed Director.

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